

CLAIMS

We claim:

1. An epoxy powder coating composition comprising an intimate mixture of:
 - 5 (a) at least one epoxy resin;
 - (b) about 0.02 to about 6.0 wt.%, based on total weight of the powder coating composition, of at least one alkanolamine;
 - (c) at least one epoxy curing agent in an effective amount to cure said powder coating composition; and
 - 10 (d) optionally at least one zinc borate compound;wherein said components (a), (b), (c) and (d) are not reacted prior to being mixed together.

2. The coating composition according to claim 1, wherein the at 15 least one epoxy resin is selected from di-glycidyl ethers of 4,4-(bishydroxyphenyl) alkanes, phenol novolac epoxy functional resins, cresol novolac epoxy functional resins, bisphenol-A/ epichlorohydrin epoxy functional resins, and mixtures thereof.

- 20 3. The coating composition according to claim 1, wherein said at least one alkanolamine comprises at least one of

- (i) R_1
|
25 H-N-H

wherein R_1 is a linear or branched alkyl group of 1 to 10 carbons containing at least one primary hydroxyl group;

- 30 (ii) R_1
|

H-N-R₂

wherein:

5 R₁ is a linear or branched alkyl group of 1 to 10 carbons, or a linear or branched alkyl group of 1 to 10 carbons containing at least one primary hydroxyl group; and

R₂ is a linear or branched alkyl group of 1 to 10 carbons containing at least one primary hydroxyl group; and

10 (iii) mixtures thereof.

4. The coating composition according to claim 1, wherein the at least one alkanolamine is selected from diethanolamine, ethanolamine, 2-amino-1-butanol, 2-amino-2-methyl-1-propanol, 2-amino-2-ethyl-1,3-propanediol, tris(hydroxymethyl)aminomethane, 2-amino-2-methyl-1,3-propanediol, monomethylaminoethanol, isopropylaminoethanol, t-butylaminoethanol, ethylaminoethanol, n-butylaminoethanol, isopropanolamine, diisopropanolamine, and mixtures thereof.

20 5. The coating composition according to claim 1, wherein the at least one alkanolamine ranges from about 0.1 to about 0.5 wt.%.

6. The coating composition according to claim 1, wherein the at least one curing agent is an epoxy curing compound selected from aromatic amines, acid anhydrides, acids, aromatic acids, mercaptans, phenolics, dicyandiamide derivatives having an addition reactivity and self-polyaddition catalytic activity, imidazoles, imidazole adducts, hydrazides, and mixtures thereof.

30 7. The coating composition according to claim 1, comprising from about 0.5 to about 4.75 % by weight, based upon total weight of the powder coating composition, of said at least one zinc borate compound.

8. The coating composition according to claim 7, wherein said at least one zinc borate compound is selected from zinc metaborate, basic zinc borate, zinc borate, and mixtures thereof.

5 9. The coating composition according to claim 1, further comprising at least one filler selected from calcium oxide, calcium silicate, barium sulfate, and mixtures thereof.

10 10. The coating composition according to claim 1, further comprising at least one additive selected from pigments, dyes, flow control agents, dispersants, thixotropic agents, adhesion promoters, antioxidants, light stabilizers, curing catalysts, anticorrosion agents, substituted benzotriazoles, thermoplastic polymers, and mixtures thereof.

15 11. A method of cathodic protection for an iron containing metallic material having at least one surface, comprising:

(a) subjecting the surface of the iron containing metallic material to a mechanical treatment, and then

20 (b) applying the coating composition of claim 1 to said surface, and finally

(c) polarizing the iron containing metallic material having the coating composition of claim 1 coated thereon as a cathode.

25 12. The method of cathodic protection according to claim 11, further comprising coating an adhesive and/or a heavy duty protective film and/or a finishing layer over the coating composition applied in step (b).

30 13. A process for coating a metal substrate comprising applying the coating composition according to claim 1 to a metal substrate and curing said coating composition.

14. The process according to claim 13, further comprising pre-heating the substrate to a temperature ranging from about 350 to about 470° F prior to applying the coating composition of claim 1.

5 15. The process according to claim 13, wherein said substrate is cured at a temperature ranging from about 300 to about 450° F.

10 16. The process according to claim 13, further comprising coating a heavy duty protective film and/or a finishing layer over the coating composition of claim 1.

17. The process according to claim 13, wherein said substrate is a pipe having an internal and/or external surface and said coating composition is applied to the internal surface and/or the external surface.

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18. A metal substrate coated with the composition according to claim 1.

20 19. The substrate according to claim 18, wherein said substrate is a pipe.

20. The substrate according to claim 18, wherein said substrate is a rebar.

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21. An epoxy powder coating composition comprising an intimate mixture of:

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- (a) at least one solid epoxy resin;
- (b) about 0.02 to about 6.0 wt.%, based on total weight of the powder coating composition, of tris(hydroxymethyl)aminomethane;
- (c) an effective amount of tetra phenol ethane to cure the powder coating composition; and
- (d) an effective amount of at least one catalyst;

wherein said components (a), (b) and (c) are not reacted prior to being mixed together.

22. An epoxy powder coating composition comprising an intimate mixture of:

- (a) at least one solid epoxy resin;
- (b) about 0.02 to about 6.0 wt.%, based on total weight of the powder coating composition, of tris(hydroxymethyl)aminomethane;
- (c) about 0.5 to 4.75 wt.%, based upon total weight of the powder coating composition, of at least one zinc borate compound;
- (d) an effective amount of tetra phenol ethane to cure the powder coating composition; and
- (e) an effective amount of at least one catalyst;

wherein said components (a), (b), (c) and (d) are not reacted prior to being mixed together.

23. An epoxy powder coating composition comprising an intimate mixture of:

- (a) at least one solid epoxy resin;
- (b) about 0.02 to about 6.0 wt.%, based on total weight of the powder coating composition, of tris(hydroxymethyl)aminomethane;
- (c) an effective amount of dicyandiamide to cure the powder coating composition; and
- (d) an effective amount of at least one catalyst;

wherein said components (a), (b) and (c) are not reacted prior to being mixed together.

24. A process for making a curable epoxy powder coating composition comprising

- (a) adding at least one epoxy resin to a mixing container;

(b) adding about 0.02 to about 6.0 wt.%, based on total weight of the powder coating composition, of at least one alkanolamine to the mixing container;

5 (c) adding at least one epoxy curing agent in an effective amount to cure said powder coating composition to the mixing container; and

(d) mixing components (a), (b) and (c) together,
wherein said components (a), (b) and (c) are not reacted prior to being added to the mixing container.

10 25. A process for making a curable epoxy powder coating composition comprising

(a) adding at least one epoxy resin to a mixing container;

(b) adding about 0.02 to about 6.0 wt.%, based on total weight of the powder coating composition, of at least one alkanolamine to the 15 mixing container;

(c) adding about 0.5 to about 4.75 wt.%, based on total weight of the powder coating composition, of at least one zinc borate compound;

(d) adding at least one epoxy curing agent in an effective amount to cure said powder coating composition to the mixing container;
20 and

(e) mixing components (a), (b) (c) and (d) together,
wherein said components (a), (b), (c) and (d) are not reacted prior to being added to the mixing container.